ROUTING NETWORKS FOR USE WITH WATERMARK SYSTEMS

Related Application Data

This application claims priority from provisional application 60/257,822, filed

5   December 21, 2000.

Field of the Invention

The present invention relates to routers, and more particularly relates to routers used in linking to computer resources based on data represented in digital watermarks,

10   bar codes, or the like.

Background and Summary of the Invention

Digital watermarking is the science of encoding physical and electronic objects with plural-bit digital data, in such a manner that the data is essentially hidden from

15   human perception, yet can be recovered by computer analysis. In physical objects, the data may be encoded in the form of surface texturing, or printing. Such marking can be detected from optical scan data, e.g., from a scanner or web cam. In electronic objects (e.g., digital audio or imagery – including video), the data may be encoded as slight variations in sample values. Or, if the object is represented in a so-called orthogonal

20   domain (also termed "non-perceptual," e.g., MPEG, DCT, wavelet, etc.), the data may be encoded as slight variations in quantization values or levels. The present assignee's patent 6,122,403, and application 09/503,881, are illustrative of certain watermarking technologies.

Watermarking can be used to tag objects with a persistent digital identifier, and

25   as such finds myriad uses. Some are in the realm of device control – e.g., tagging video data with a do-not-copy flag that is respected by compliant video recorders. (The music industry's Secure Digital Music Initiative (SDMI), and the motion picture industry's Copy Protection Technical Working Group (CPTWG), are working to establish standards relating to watermark usage for device control.) Other watermark

applications are in the field of copyright communication, e.g., indicating that an audio track is the property of a particular copyright holder.

The present invention most particularly concerns watermark applications that encode data to associate an object with a store of related data. For example, an image watermark may contain an index value that serves to identify a database record specifying (a) the owner's name; (b) contact information; (c) license terms and conditions, (d) copyright date, (e) whether adult content is depicted, etc., etc. (The present assignee's MarcCentre service provides such functionality.)

Another watermark application that encodes data to associate an object with a store of related data, is so-called "connected content" technology. In such applications, a watermark in one content object (e.g., a printed magazine article) serves to link to a related content object (e.g., a web page devoted to the same topic). The watermark can literally encode an electronic address of the related content object, but more typically encodes an index value that identifies a database record containing that address information. Application 09/571,422 details a number of connected-content applications and techniques. The present assignee markets such technology under the brand "Digimarc MediaBridge." In the Digimarc MediaBridge offering, the system that associates object identifiers with corresponding computer resources is termed the "Grand Central" router.

In accordance with one aspect of the present invention, a single router is not used. Instead, several routers are available, and are utilized in manners designed to speed system response time.

The foregoing and other features and advantages of the present invention will be more readily apparent from the following detailed description.

Detailed Description

To speed response time in systems like those referenced above (including the Digimarc MediaBridge application detailed in application 09/571,422), it is desirable that the responding system be located close – in network terms – to the client application or device.

It has been the intent from the outset to have more than one Digimarc MediaBridge Grand Central router, and to field them at various locations throughout the US and internationally.

Based on the location of the user (using the country code or postal code they have stored on their computer or have given to Digimarc during the software registration process), we communicate with a specific Digimarc MediaBridge Grand Central router located closest to them geographically (or network-geographically).

When a user connects between their PC and a website hosted on a computer somewhere else in the world, the connection is not normally a single connection between just those two computers. The Internet isn't built that way. The Internet takes the user's request (specified via the Uniform Resource Locator - URL) and routes the user through whatever intermediary computers, routers and switches that seem appropriate at the time of the user's request. This mechanism is similar in many ways to making a long-distance phone call. Each of the connections through an intermediary is called a 'hop'. Typically, the further away the URL is geographically located on the world-wide web, the more 'hops' it takes to make the connection. The more 'hops' the more latency is introduced as each intermediary point and the slower the actual response and the less reliable the connection.

All communication between the Digimarc MediaBridge reader/detector application and the Digimarc MediaBridge Grand Central router is accomplished by sending messages back and forth over the Internet. One of the ways that Digimarc improves the reliability of its service and can slightly increase its speed is to minimize the 'hops' in the user's connection with the Digimarc MediaBridge Grand Central router. The simplest way to do this is to find the Digimarc MediaBridge Grand Central router geographically closest to the user.

One approach to this goal works as follows:

The reader/detector queries a "master" router when the reader/detector application is first invoked, sending along the country or postal code from the user's computer

The "master" router matches the country or postal code to the appropriate Digimarc MediaBridge Grand Central router - the one closest to the user and sends that reply back to the reader/detector application

The reader/detector application now uses this supplied closest Digimarc MediaBridge Grand Central router for all future communications required to perform its ID to action association functions

A simple 'hop' map currently might look like this -

- originating user in Glenmoore, PA 19343. Digimarc MediaBridge Grand Central router located in Tulsa, OK.
    - Glenmoore to Paoli, PA (ISP dial in connection point)
    - to Philadelphia, PA (Internet "hub")
    - to Dallas, TX (Internet "hub")
    - to Tulsa, OK (Internet "hub")
    - to Digimarc Offices in Tulsa, OK

With a second Digimarc MediaBridge Grand Central router located in Philadelphia, the 'hop' map looks like -

- Glenmoore to Paoli, PA (ISP dial in connection point)
- to Philadelphia, PA (Internet "hub")
- to Philadelphia Digimarc MediaBridge Grand Central router

If the second Digimarc MediaBridge Grand Central router is located in New York, NY, the 'hop' map looks like -

- Glenmoore to Paoli, PA (ISP dial in connection point)
- to Philadelphia, PA (Internet "hub")
- to NY, NY (Internet "hub")
- to NY Digimarc MediaBridge Grand Central router

Application 09/571,422 also disclosed methods for handling watermark-based requests from client applications based, e.g., on the watermark's "type" and "number."

In an enhanced system, the client application can specify a router/product handler, allowing the Back Office facility to better load balance versus the associated

watermark registry database. The client application can do this by appending a router name/number to the basic URL it now uses to communicate with the Back Office. Each of these "type-specific" Back Office router/product handlers can be responsible for servicing a specific, smaller portion of the entire registry database, speeding up their

5 performance and keeping the consumer's perceived response time short.

This enhancement can be in addition to the "geographic routing" feature detailed above.

To provide a comprehensive disclosure without unduly lengthening this specification, the patents and applications cited in this specification are incorporated

10 herein by references.

Having described and illustrated the subject technologies with reference to illustrative embodiments, it should be recognized that the invention is not so limited. For example, while the illustrative embodiment employed digital watermarking technology, the same principles can be applied in other contexts, such as bar code-

15 based systems. Systems for linking to computer resources based on bar code indicia are shown, e.g., in U.S. patents 6,314,457, 6,154,738, 6,108,656, and 5,913,210.

The implementation of the functionality described above (including watermark decoding) is straightforward to artisans in the field, and thus not further belabored here. Conventionally, such technology is implemented by suitable software, stored in long

20 term memory (e.g., disk, ROM, etc.), and transferred to temporary memory (e.g., RAM) for execution on an associated CPU. In other implementations, the functionality can be achieved by dedicated hardware, or by a combination of hardware and software. Reprogrammable logic, including FPGAs, can advantageously be employed in certain implementations.

25 It should be recognized that the particular combinations of elements and features in the detailed embodiments are exemplary only; the interchanging and substitution of these teachings with other teachings in this and the incorporated-by-reference patents/applications are also contemplated.

In view of the wide variety of embodiments to which the principles and features

30 discussed above can be applied, it should be apparent that the detailed embodiments are

illustrative only and should not be taken as limiting the scope of the invention. Rather, I claim as my invention all such modifications as may come within the scope and spirit of the following claims and equivalents thereof.